

REMARKS

Claims 5-18 are pending. By this Amendment, claims 5, 11, 12, 16 and 17 are amended, claims 1-4 are canceled without prejudice to, or disclaimer of the subject matter contained therein, and new claim 18 is added. Reconsideration is respectfully requested in view of the above amendments and the following remarks.

I. Objection to Specification

The Office Action objects to the specification. The specification has been amended to obviate the objection. Accordingly, withdrawal of the objection to the specification is respectfully requested.

II. Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 1-17 under 35 U.S.C. §112, second paragraph as being indefinite. In particular, the 35 U.S.C. §112, second paragraph rejection is directed to claim 1. Claim 1 has been canceled, and thus the rejection with respect to this claim is now moot. Accordingly, withdrawal of the rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

III. The Claims Define Patentable Subject Matter

The Office Action rejects claims 1-17 under 35 U.S.C. §103(a) over Sasaki (JP 411339223A) in view of Hara (U.S. Patent No. 5,946,167) and further in view of Ichihara (U.S. Patent No. 5,607,559). The rejection is respectfully traversed.

None of the references, individually or in combination, discloses or suggests a first step of forming the first magnetic material layer on the gap layer made of aluminum oxide, and patterning the first magnetic material layer through the use of a first mask made of aluminum oxide by reactive ion etching so as to form at least the first uniform width portion of the first magnetic layer, a second step of selectively removing a region of the gap layer excluding a portion that includes to the first uniform width portion of the first magnetic layer

by reactive ion etching, and a third step of patterning a second magnetic material layer by reactive ion etching so as to form at least the second uniform width portion of the second magnetic layer, wherein in the first, second, and third steps, the reactive ion etching is performed in a chlorine gas atmosphere at a temperature ranging from 150°C to 250°C, as recited in independent claim 18.

The individual references or their combination does not render obvious the above-noted features of the claim because they do not contemplate all of the material of the first mask, the material of the gap layer, the kind of etching gas to be used, and the etching temperature. Therefore, a desired benefit and advantage of the claimed invention cannot be obtained, that is the first width uniform portion is formed with high precision and in a short period of time.

Specifically, the first mask is made of aluminum oxide having an etching rate slower than that of the first magnetic material layer. Therefore, the first mask is hard to etch when etching is performed. Consequently, the first magnetic material layer is patterned so as to accurately reflect a patterning shape of the first mask, and thus the first uniform width portion is formed with high precision.

The gap layer is made of aluminum oxide having an etching rate slower than that of the first magnetic material layer. Therefore, the gap layer functions as a stopper layer when etching is performed, that is the first magnetic material layer is patterned. Consequently, a progress of etching becomes controllable when the first magnetic material layer is etched.

The gap layer and the first mask are hard to etch (scatterings are hard to occur at etching) while the first magnetic material layer is easy to etch (scatterings are easy to occur at etching), and therefore the amount of reattachment is reduced when the first magnetic material layer is etched. Thus, a width of etching is uniformed and the first uniform width portion can be formed so as to have a uniform width.

Also, a ratio of selection between the first magnetic material layer to be etched and the gap layer and the first mask that are not to be etched is secured (the difference of the etching rates becomes large enough). In such a manner, only the first magnetic material layer can be etched without etching the gap layer and the first mask.

A chlorine gas is employed as an etching gas and an etching temperature is set between 150°C-250°C. The etching temperature is set between 150°C-250°C because a thermal damage to the elements in the periphery when an etching is performed can be prevented. For example, when the etching temperature is equal to or more than 300°C, noise amount of the MR elements is increased.

In contrast to the applied references, in the claimed invention, all of the reactive ion etching in the first, second and third steps are performed by one kind of gas (chlorine gas) at a temperature ranging from 150°C to 250°C.

Furthermore, the first uniform width portion is formed in a short time because reactive ion etching has a faster etching speed than ion milling.

Sasaki, in the Abstract, discloses a method of making a thin-film magnetic head, where first and second magnetic layers, each including a magnetic pole are magnetically coupled to each other. Sasaki (U.S. Patent No. 6,419,845) uses reactive ion etching and ion milling together. Moreover, the above reference merely describes that reactive ion etching has chemical etching effect and, therefore, it has material selectivity. Hara discloses using reactive ion etching. Ichihara discloses a processing temperature in a range of 100 to 300 degrees. But none of the references contemplate the series of technical functions and effects, as described above. Thus, one skilled in the art would not derive at the claimed invention based on the disclosures of Sasaki, Hara and Ichihara. In fact, the motivation to combine Sasaki, Hara and Ichihara could only have come from the disclosure of the present application, which of course, is impermissible hindsight.

Therefore, independent claim 18 defines patentable subject matter. Claims 5-17 depend from independent claim 18, and therefore also define patentable subject matter as well as for the other features they recite. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

IV. Rejection Under the Judicially Created

Doctrine of Obviousness-Type Double Patenting

The Office Action rejects claims 1-4 and 12-13 under the judicially created doctrine of obviousness-type double patenting over claim 1 of U.S. Patent No. 6,854,175. A Terminal Disclaimer is filed to obviate the rejection. Accordingly, withdrawal of the rejection under the judicially created doctrine of obviousness-type double patenting is respectfully requested.

V. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 5-18 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Attachment:
Terminal Disclaimer

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